FUNGAL BIOLOGY 115 (2011) 935–936

ELSEVIER

British Mycological Society promoting fungal science

journal homepage: www.elsevier.com/locate/funbio

Editorial

The emerging potential of melanized fungi: black yeast between beauty and the beast

Isn't it a discomforting thought that brain-eating black yeasts are staring at us while we are showering? And that they may sit in our teacup that comes fresh from the dishwasher? Only very recently have we realized that black yeasts are all around us. They cover sunlit roofs and the brick walls of our homes. They clot the machine-oil hydraulics of ship engines. They cover parked cars with sticky slime. They multiply on creosote-protected wooden fences. But we don't notice them, because their growth is very slow, and their microscopic visage lacks any kind of beauty. This is why mycologists have neglected them over decades. But with the advent of molecular phylogenetic research we are now beginning to understand that the black yeasts represent a world of fascinating creatures with unusual biological activities. Our understanding of black yeasts is just beginning.

Black yeasts are ecologically remarkable: they always live in extreme, unusual and toxic environments. They produce melanin and thick cell walls that protect them from solar radiation and other environmental challenges. In this issue, **Selbmann *et al.*** demonstrate the incredible tolerance of an Antarctic rock fungus against UV irradiation: *Saccharomyces* is killed by a fraction of the dose that leaves the black fungus undisturbed. There are even species that absorb radiation as a source of energy, as **Dadachova *et al.*** describe. **Turk *et al.*** suggest that the level of plasma-membrane fluidity and its fluctuation are indicators of fitness for survival and adaptability in fungi isolated from extreme environments. **Lenassi *et al.*** explain the cellular mechanisms behind the halophily of fungi living at salt concentrations near saturation. Extremotolerant organisms are difficult to work within the lab because of their poor growth, rigid cells walls and the presence of compounds that interfere with DNA extraction. **Isola *et al.*** describe specialized mechanisms of protein expression in rock-inhabiting fungi. **Grube *et al.*** applied microbial ecology tools to explore associations of black yeasts and bacteria, as interactions with other microorganisms are as yet poorly understood.

Gueidan *et al.* demonstrate that there are two very different groups of black yeasts with rock-inhabiting species among their ancestors. Melanin is useful as a sunscreen, but also helps the fungus to resist the oxidizing action of phagocytes when they are introduced into the human body. The pathogens are restricted to a single order of black yeasts. This group must have acquired some additional physiological features, but we are not sure what these are. An ability to assimilate alkylbenzenes (toxic environmental pollutants) has been hypothesized, similar to the role of dopamine in neurotropic *Cryptococcus* species. Such compounds are found in skin tissue as well as within the body (e.g. where they play a role in signal transduction in the nervous system), and the development of a degradation mechanism by a fungus predisposes this species for the evolution of pathogenicity. These types of organism are ubiquitous in our homes: **Zalar *et al.*** consistently isolate black yeasts from dishwashers. **Gostincar *et al.*** note that these opportunistic indoor fungi are quite versatile, and refer to this condition as 'polyextremotolerant'. All over the Chaetothyriales we observe twin species: one yeast associated with aromate degradation, and a pathogenic sister species. Striking examples are given by **Badali *et al.*** and **Seyedmousavi *et al.*** Virulence factors thus seem to be species-specific, and may be unevenly distributed over genotypes within a single species, as shown by **Machouart *et al.*** **Sudhadham *et al.*** followed the distribution of populations of the same opportunistic species over the globe. **Najafzadeh *et al.*** describe a new fungal agent of brain disease identified in a cat. In nature, hydrocarbon assimilation by black yeasts performs many different functions. Ants communicate by species-specific hydrocarbon molecules, and keep their nests clean from microbial contamination with creosote-like compounds. For this reason, as **Voglmayer *et al.*** show, a diversity of chaetothyrialean black yeasts proliferate in ants nests.

This issue of Fungal Biology provides a fascinating overview of the biology of black yeast-like fungi. When it comes to applications in biotechnology, bioremediation, agriculture or medicine, we are only scratching the surface of the potential of these organisms. It has been supposed that their infectious abilities may have a negative impact on these efforts, but several papers in this issue clearly show that useful properties of pathogenic species can be found in closely-related fungi that pose no danger to researchers. Our understanding of the black yeasts will be greatly enhanced by the sequencing of 14 full genomes that are in progress. Prospects for this field of mycological research are very exciting.

Nina Gunde-Cimerman
Biology Department, Biotechnical Faculty, University of Ljubljana, 1000 Ljubljana, Slovenia
E-mail address: Nina.Gunde-Cimerman@bf.uni-lj.si

Martin Grube
Institut für Pflanzenwissenschaften, 8010 Graz, Austria
E-mail address: martin.grube@uni-graz.at

G. S. de Hoog*
Fungal Biodiversity Centre KNAW, Uppsalalaan 8, 3584 CT, Utrecht, The Netherlands
**Corresponding author*. Tel.: + 31 (0)30 2122663, fax: + 31 (0)30 2512097.
E-mail address: de.hoog@cbs.knaw.nl

1878-6146/$ – see front matter

doi:10.1016/j.funbio.2011.05.003